

February 8, 2002 F/AKC2:TS

CRUISE RESULTS

Cruise 2001-01 Arcturus
Cruise 2001-01 Aldebaran

2001 Eastern Bering Sea Crab and Groundfish Survey

May-July 2001

The Resource Assessment and Conservation Engineering (RACE) Division of the Alaska Fisheries Science Center (AFSC) conducted the annual crab and groundfish bottom trawl survey of the eastern Bering Sea shelf from May to July 2001. This was a continuation of the annual series of eastern Bering Sea crab-groundfish assessment surveys which began in 1971.

OBJECTIVES

The primary objective of this survey was to continue the annual series of assessment surveys of crab and groundfish of the eastern Bering Sea to provide information for:

1. the North Pacific Fishery Management Council on the distribution, abundance, and biological condition of important groundfish and crab species;
2. the U.S. fishing industry on catch per unit effort and size composition, and;
3. the support of ongoing studies on the biology, behavior, and dynamics of key ecosystem components.

Secondary objectives were to:

1. conduct additional sampling in areas of high king crab and Tanner crab abundance to reduce variability in population estimates;

2. evaluate bottom trawl performance and configuration with net mensuration equipment;
3. sample nearshore sites near Togiak Bay, Kuskowim Bay, and Port Moller to investigate distribution of yellowfin sole and other species in areas immediately adjacent to the standard survey area;
4. sample additional sites north and east of St. Matthew Island to collect information on snow crab;
5. collect fish egg masses to help determine critical spawning habitats;
6. collect and preserve specimens of fish and invertebrates for a voucher data base;
7. collect stomach samples for trophic interaction studies;
8. collect specimens of bigmouth sculpin (*Hemitripterus bolini*), egg masses, ovaries, and sponge to describe bigmouth sculpin development and life history and;
9. collect and preserve various whole specimens and tissue samples from both fish and invertebrates for special study requests.

VESSELS AND GEAR

Sampling at the standard sites was coordinated between two chartered commercial vessels, the F/V Arcturus and F/V Aldebaran. Both vessels were 39.6 m (130 ft) in length.

The bottom trawl used at all standard sampling stations was an 83-112 eastern trawl. These nets have a 25.3 m (83 ft) headrope and a 34.1 m (112 ft) footrope (Fig. 1). They were towed behind 1,000 kg, 1.8 X 2.7 m, steel V-doors and 54.9 m (180.1 ft) paired dandyline. Each lower dandyline had a 0.61 m chain extension connected to the lower wing edge to improve bottom tending characteristics. The 83-112 eastern trawl has been the standard sampling net used during annual eastern Bering Sea surveys since 1982 when it replaced the 400 mesh eastern trawl, previously used since the 1970s.

Seawater temperature profiles were collected at most sampling sites using a micro-bathythermograph attached to the headrope of

the net. Surface seawater temperatures were also collected with a bucket thermometer.

Net mensuration systems and bottom contact sensors aboard both vessels were used to provide sampling net configuration and performance data to be used in area-swept and catch-per-unit-effort (CPUE) calculations.

ITINERARY

The Aldebaran began the bottom trawl survey in Dutch Harbor, Alaska on May 26 while the Arcturus began its portion of the survey on May 29. Prior to the beginning of the survey, the Aldebaran conducted a footrope study of the 83-112 bottom trawl beginning on May 20. The Aldebaran and Arcturus completed the standard survey on July 21 in Dutch Harbor. The Arcturus then proceeded to Pavlov Bay to continue the annual shrimp survey and returned to Dutch Harbor on July 26. Intervening port calls were made to Dutch Harbor on June 16 and at St. Paul Island on July 6 to exchange scientific personnel. One additional port call was made by the Aldebaran on June 9 to embark a scientist in Dutch Harbor.

SURVEY DESIGN AND METHODS

The standard survey area is shown in Figure 2. Sampling sites were established on the basis of a 20 x 20 nm grid pattern used during previous surveys, although more intensive sampling was carried out in the Pribilof Islands and St. Matthew Island regions to collect additional data on crab populations. Additional stations north of the standard survey area were established to estimate the abundance of Tanner crab (*Chionoecetes opilio*) in that area.

The Arcturus and Aldebaran then sampled alternate north/south columns of stations proceeding from Bristol Bay westward to the shelf edge. Tows of 30 minutes in duration were made at most sampling sites. All catches were sorted to the lowest possible taxon, weighed, and enumerated. Station data including time, position, trawl performance, distance fished as well as catch information was entered onto diskettes with shipboard computer systems. Age samples (by sex-centimeter category), size composition, and other biological data were collected from the major fish species encountered. Length-width measurements, shell condition, clutch size, and tissues and organs for various studies were collected from the major crab species. Special

study collections were stored in appropriate fixatives or were frozen.

RESULTS

The Arcturus and Aldebaran conducted 426 bottom trawls during the standard survey including 419 successfully completed trawls at scheduled sampling sites and 7 unsuccessful hauls.

Biological data collected from fish species are summarized in Table 1. The two vessels recorded 179,365 length measurements from the major fish species and 5,218 age structures were collected and preserved. Individual length-weight data were also recorded during the otolith collection process. A total of 6,632 stomachs were preserved from various fish taxa for feeding habit analysis.

Whole specimens and tissue samples of various fish and invertebrate species were preserved for identification, training, and other purposes.

The total standard survey area encompassed approximately 463,400 km². Catch rates of important fish and crab species, by depth zone, are shown in Table 2.

Walleye pollock (*Theragra chalcogramma*) was the most abundant round-fish species and had an overall CPUE of 88.3 kg/ha trawled. They were encountered at nearly all sampling sites, with largest mean catches (150.4 kg/ha) observed in outer shelf waters at depths of 100-200 m (Fig. 3). Mean catches were much lower at depths less than 50 m (23.4 kg/ha).

Northern rock sole (*Lepidopsetta polyxystra*) and yellowfin sole (*Limanda aspera*) were the most abundant flatfish species, with overall CPUE values of 53.5 kg/ha and 39.3 kg/ha, respectively. Yellowfin sole were primarily restricted to the central and inner shelf waters, while rock sole were more broadly distributed with concentrations in Bristol Bay, around the Pribilof Islands, and the outer shelf (Figs. 4 and 5). Yellowfin sole catches decreased sharply with increased depth, from 94.6 kg/ha in waters less than 50 m to less than 0.1 kg/ha in waters greater than 100 m (Table 2). A similar depth-related decrease in rock sole abundance was also observed.

Pacific cod (*Gadus macrocephalus*) were encountered at most of the sites sampled (Fig. 6). Mean catch rates were smallest at inner

shelf stations less than 50 m (11.7 kg/ha) and greatest in the central shelf region (14.5 kg/ha).

Alaska plaice (*Pleuronectes quadrituberculatus*), flathead sole/Bering flounder (*Hippoglossoides elassodon* and *H. robustus*), arrowtooth/Kamchatka flounder (*Atherestes stomias* and *A. evermanni*), and Pacific halibut (*Hippoglossus stenolepis*) had a combined catch rate of 33.5 kg/ha. Alaska plaice and flathead sole/Bering flounder were the most abundant species of this group, with an overall catch rate of 11.4 kg/ha and 10.6 kg/ha respectively.

Opilio Tanner crab was the most abundant commercially important crab species encountered, with a total average catch rate of 4.7 kg/ha. Red king crab (*Paralithoides camtschatica*) had an overall mean CPUE of 1.6 kg/ha while blue king crab (*P. platypus*) and Bairdi Tanner crab (*C. bairdi*) had overall catch rates of 0.2 kg/ha and 0.9 kg/ha trawled respectively.

SCIENTIFIC PERSONNEL^a**Arcturus**Leg 1

J. Hoff^b
 R. Harrison
 A. Cross
 B. Krivonak^c
 R. MacIntosh^d
 L. Rugolo^d

Leg 2

D. Benjamin^b
 G. Lang
 W. Shockley
 B. Krivonak^c
 B. Stevens^d
 K. Swiney^d

Leg 3

J. Hoff^b
 E. Acuna
 V. Lowe
 B. Krivonak^c
 R. MacIntosh^d
 K. Gravel^d

AldebaranLeg 1

D. Nichol^b
 T. Buckley 5/26 - 6/6
 K. Weinberg
 F. Morado
 P. Cummiskey^d
 S. Persellin^d
 D. Benjamin 6/9 - 6/16

Leg 2

D. Nichol^b
 E. Acuna
 M. Nelson
 L. Appesland
 E. Munk^d
 J. Kuras^d

Leg 3

B. Otto^{bd}
 D. Benjamin
 G. Mundell
 P. Risse
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Table 1.--Biological data collected during the 2001 eastern Bering Sea crab-groundfish survey.

Species	Length measurements	Age structures ^{1/2/}	Stomach samples
Walleye pollock	46,997	1,679	2,813
Pacific cod	19,121	979	2,433
Yellowfin sole	27,677	798	--
Rock sole	30,331	446	--
Flathead sole/ Bering flounder ^{3/}	19,842	537	--
Pacific halibut	1,802	1,001	--
Alaska plaice	12,403	339	--
Arrowtooth flounder/ Kamchatka flounder	9,774	--	518
Greenland turbot	274	217	--
Rex sole	1,826	--	--
Longhead dab	1,430	223	--
Plain sculpin	1,693	--	--
Misc. sculpins	840	--	--
Starry flounder	559	--	--
Alaska skate	3,220	--	--
Arctic cod	758	--	10
Sakhalin sole	514	--	--
Misc. skates	201	--	868
Misc. species	102	--	--
Total	179,365	5,218	6,632

^{1/} Scale scrape samples, in addition to otoliths, were collected from Pacific cod. Only otoliths were taken from all other species.

^{2/} Individual length-weight data were also collected.

^{3/} Age structures were collected from flathead sole only.

Table 2.--Catch rates (kg/ha) by depth zone of commercially important fish and crab species taken aboard the Arcturus and Aldebaran during the 2001 eastern Bering Sea crab-groundfish survey.

Species	Inner shelf < 50 m	Central shelf 50-100 m	Outer shelf 100-200 m	Total area
Walleye pollock	23.4	88.0	150.4	88.3
Yellowfin sole	94.6	32.3	<0.1	39.3
Rock sole	121.8	45.2	4.3	53.5
Pacific cod	11.7	23.4	14.5	18.2
Alaska plaice	12.3	15.9	2.2	11.4
Flathead sole/ Bering flounder	1.8	10.9	18.3	10.6
Arrowtooth flounder/ Kamchatka flounder	0.1	5.4	21.3	8.3
Pacific halibut	3.9	2.7	3.5	3.2
Opilio Tanner crab	0.2	6.9	4.7	4.7
Red king crab	1.5	2.5	0.0	1.6
Bairdi Tanner crab	0.1	1.0	1.5	0.9
Blue king crab	0.0	0.4	<0.1	0.2